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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/605,108	09/09/2003	Dureseti Chidambarrao	FIS920030183US1	2107

29625 7590 10/26/2004

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EXAMINER	
PHAM, LONG	

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 10/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/605,108	CHIDAMBARRAO ET AL.	
	Examiner	Art Unit	
	Long Pham	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-18 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-18 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings were received on 06/02/04. These drawings are approved.

General Information

Paper copies of cited U.S. patents and U.S. patent application publications will cease to be mailed to applicants with Office actions as of June 2004. Paper copies of foreign patents and non-patent literature will continue to be included with office actions. These cited U.S. patents and patent application publications are available for download via the Office's PAIR. As an alternate source, all U.S. patents and patent application publications are available on the USPTO web site (www.uspto.gov), from the Office of Public Records and from commercial sources. Applicants are referred to the Electronic Business Center (EBC) at http://www.uspto.gov/ebc/index.html or 1-866-217-9197 for information on this policy. Requests to restart a period for response due to a missing U.S. patent or patent application publications will not be granted.

Rejections and/or objections as previously applied

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

1. Claims 1, 2, 3, 4, 5, 6, 12, 13, 14, 15, 16, 17, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art (AAPA) of this application in combination with Nayak (US 6,372,590).

With respect to claims 1, 2, 3, 4, 12, 13, 14, 15, 16, 17, and 18, AAPA teaches a method for manufacturing a semiconductor device, comprising steps of (see the Background of Invention of this application):

forming source and drain regions in an upper surface of a SiGe-based substrate, the source and drain regions containing an n-type impurity.

AAPA fails to teach forming source and drain extension regions in the upper surface of substrate and implanting nitrogen into the source and drain extension regions.

Nayak teach forming n-type source and drain extension regions in an upper surface of an substrate and then implanting nitrogen with implantation dose of 1x 10^{14} to 5x 10^{15} atoms/cm^2 and implantation energy of 1KeV to 100KeV into the source and drain extension regions to reduce series resistance and hot carrier effects. See the abstract of Nayak.

It would have been obvious to one of ordinary skill in the art of making semiconductor devices to form source and drain extension regions in the upper surface of substrate and implant nitrogen with implantation dose of 1x 10^{14} to 5x 10^{15} atoms/cm^2 and implantation energy of 1KeV to 100KeV into the source and drain extension regions to obtain above advantages.

With respect to claim 6, AAPA further teaches that the SiGe-based substrate comprises a Si cap layer on a SiGe film on a silicon substrate.

2. Claims 7, 8, 9, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art (AAPA) of this application in combination with Nayak (US 6,372,590).

With respect to claims 7 and 8, Nayak fails to teach that the peak concentrations of the implanted nitrogen and n-type impurity of the source and drain extension regions are at the same depth from the upper surface of the substrate.

However, it would have been obvious to one of ordinary skill in the art of making semiconductor devices to determine the workable or optimal value or range for the depth for the peak concentrations of the implanted nitrogen and impurity through routine experimentation and optimization to obtain optimal or desired device performance because the relative depths of the nitrogen and impurity are result-effective variables and there is no evidence indicating that they are critical or produce any unexpected results and it has been held that it is not inventive to

discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

With respect to claim 9, annealing is well-known to one of ordinary skill in the art of making semiconductor devices.

With respect to claim 10, the annealing temperature and duration are result-effective variables and there is no evidence indicating that they are critical or produce any unexpected results and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

With respect to claim 11, AAPA implicitly teaches forming a gate electrode on the upper surface of SiGe-based substrate with a gate oxide film therebetween. See the Background of Invention.

Response to Arguments

3. Applicant's arguments filed 07/30/04 have been fully considered but they are not persuasive. See below.

In response to the applicants' arguments in paragraphs at the bottom half of page 7 of the response dated 07/30/04, it is submitted that since AAPA in combination with Nayak teach implanting the nitrogen or vacancy-trapping element into the source and drain extension regions, the vacancy concentration in the source and drain regions would inherently be reduced and consequently diffusion of N type impurity in the source and drain extension regions would inherently be decreased. See the rejection.

In response to the applicants' arguments in the first three full paragraphs on page 8 of the response dated 07/30/04, it is submitted that the present claims 1, 2, and 3 clearly require implanting nitrogen or vacancy-trapping element into the source and drain extension regions to reduce the vacancy concentration in the

source and drain extension regions to decrease the diffusion of N type impurity in the source and drain extension regions.

In response to the applicants' arguments in the first full paragraph on page 9 of the response dated 07/30/04, it is submitted that the present claims 1, 2, and 3 clearly require either implanting interstitial element (Si or O of claim 2) **OR** implanting vacancy-trapping element (F, N, Xe, Ar, He, Kr, **or** a noble gas of claim 3), **not BOTH** to reduce the vacancy concentration.

In response to the applicants' arguments in the paragraphs bridging pages 9 and 10 of the response dated 07/30/04, it is submitted that the fact that the applicants have a different reason or advantage resulting from doing what the relied prior art suggested doing is not indicative or demonstrative of unobviousness. In Re Kronig 190 USPQ 425,428 (CCPA 1976); In Re Lintner 173 USPQ 560 (CCPA 1972). The prior art motivation or advantage may be different that that of applicants while still supporting a conclusion of obviousness. In Re Wiseman 201 USPQ 658 (CCPA); Ex Parte Obiaya 227 USPQ 58 (Bd. of App. 1985).

With respect to the applicants' challenges to the official notice taken the rejection, prior art references are included to show the well-known teaching. Section [0037] of Fukuda et al. (US 2002/0047125) and section [0071] of Yokogawa et al. (US 2003/0227061) both teach implantation of an element or specifically nitrogen and subsequent activation annealing.

With respect to the applicants' challenges of alleged optimizations of peak concentrations of nitrogen and n type impurity in the source and drain extension regions and optimizations of annealing temperature and duration, it is submitted that the applicants have the burden of showing the claimed ranges are critical. Also, it is submitted that the applicants have not sufficiently shown that the ranges are critical.

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Long Pham whose telephone number is 571-272-1714. The examiner can normally be reached on M-F, 7:30AM-3:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Long Pham
Primary Examiner
Art Unit 2814

LP